Prescriptive Analytics Using Simulation Models

by Mark Peco

Module 0. About the Course (8 min)

Module 1. Introduction (54 min)
- *Overview*
- *Basic Concepts*
  - Business Intelligence
  - Analytics
  - Real and Virtual Domains
  - Systems and Interfaces
  - General System Structure
  - Properties of Systems
  - Systems Examples
  - Variables and Relationships
  - Models and Simulation
  - Data and Information
  - Insights
- *Capabilities of Simulation*
  - Discovering and Experimentation
  - Learning
  - Monitoring and Surveillance
  - Generating Business Insight
- *Business intelligence Framework*
  - Historical Context
  - BI System Components Overview
  - Value Generation Components
  - Monitoring and Learning Components
  - Leadership and Alignment Components
  - Putting the Pieces Together
- *Simulation Framework*
  - Overview
  - Context
  - Approach
  - Basic Components
  - Analytics Components
  - Roles
  - Time
  - Organization
- *Review*

Module 2. Principles and Practices (38 mins)
- *Overview*
- *Context and Opportunities*
  - Pursuing Goals
  - Online Problems
  - Generating Insights
  - Decision Support
- *Application Areas*

- o Overview
- o Business Processes
- o Industrial Processes
- o Physical Processes
- o Economics
- o Queues and Discrete Events
- *System Models*
  - o Representing Reality
  - o Model Categories
  - o Defining the Structural Model
  - o Defining the Functional Model
  - o Defining the System Model
  - o State Variables and Relationships
  - o Properties of Systems
  - o Components and Structure
  - o Modeling Categories
- *Model Components*
  - o Overview
  - o Quantitative Data
  - o Qualitative Data
  - o Relationships
  - o Interactions
  - o Engine
- *System Simulation*
- *Review*

Module 3a. Modeling Techniques—Part I (60 mins)

- *Overview*
  - o Approaches and Techniques
  - o Classifying Models by System Properties
  - o Selecting a Modeling Method
  - o Approaches and Techniques
  - o Combining Techniques
- *Continuous Physical Models*
  - o Description and Purpose
  - o Modeling Approach
  - o Identifying Relationships
    - ▪ Structural Model
    - ▪ Functional Model
    - ▪ Simulated Results
  - o Application Areas
- *Business Process Models*
  - o Description and Purpose
  - o Modeling Approach
  - o Example
    - ▪ Order Fulfillment Process
    - ▪ Structural Model
    - ▪ Adding the Behavior Model Components

- Process Resources
- Business Process Model Example
- Business Scenario Defined
- Business Scenarios
- Analyzing the Results
- Scenario Selection
  - o Application Areas
- *Stock and Flow Models*
  - o Description and Purpose
  - o Modeling Approach
  - o Example 1
    - Bank Account
    - Model Structure
    - Model Equations
    - Results
  - o Example 2
    - Business Loan
    - Structural Model
    - Behavioral Model Scenarios
    - Scenario 1
    - Scenario 2
    - Scenario 3
    - Scenario 4
    - Analysis Summary
  - o Application Areas

Module 3b. Modeling Techniques—Part II (43 mins)
- *Monte Carlo Models*
  - o Description
  - o Modeling Approach
  - o Approach 1-2
  - o Example
    - Gas Compressor Model
    - Input Variable X2 – Flow
    - Input Variable X3 – Suction Pressure
    - Output Variable Y1 - Horsepower
  - o Application Area
- *Discrete Event Models*
  - o Purpose and Structure
  - o Approach
  - o The Poisson Probability Distribution
  - o Example
    - The Base Case
    - Off Peak Period
    - Peak Period
    - Solution Options
    - Solution Option 1
    - Solution Option 2
  - o Application Areas

- *Empirical Models*
  - Description and Purpose
  - Approach
  - Example
    - Example Scenario
    - Data Preparation
    - Word of Caution
    - Model Generation Part 1
    - Model Generation Part 2
    - Model Evaluation
- *Review*

Module 4. Simulation (49 mins)
- *Overview*
- *Opportunities and Techniques*
  - Introduction
  - Operation Decisions
  - Planning And Design
  - Surveillance
  - Virtual Measurements
  - Experimentation
  - Monitoring and Control
- *Data Management Considerations*
  - Introduction
  - Data Categories
  - Traditional Linear Approach with Limitations
  - Managing Data Properties
  - The Simulation and Data Ecosystems
  - Modified Approach Based on Feedback
- *Simulation and the BI Program*
  - Defining the Scope
  - Governance and Leadership
  - Competencies and Skills Development
- *Case Study*
  - Introduction
  - Business Reality
  - Business Reality Expanded
  - System Components
  - System Structural Model
  - Structural Model Variables
  - Functional Model Variables
  - System Model
  - Simulation
  - Design of Experiments
  - Output Analysis
  - Decisions
  - Actions
  - Case Study Review

- *Review*
- *Course Summary*